

Single Photon Sensitive HgCdTe Avalanche Photodiode Detector (APD), Phase II

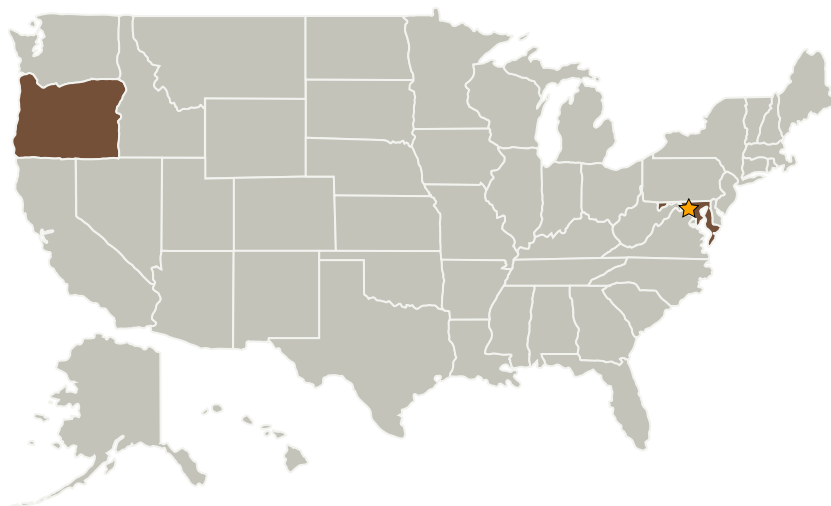
Completed Technology Project (2007 - 2010)



Project Introduction

Leveraging Phase I SBIR successes, in Phase II, a single photon sensitive LIDAR receiver will be fabricated and delivered to NASA. In Phase I, high-gain, electron-initiated avalanche photodiodes (e-APDs) were designed, manufactured, and characterized over a range of temperatures. The e-APDs, sensitive from 1064 nm to 4300 nm, were fabricated in single-layer p-type HgCdTe films grown using liquid phase epitaxy on IR-transparent CdZnTe substrates. Variable-diameter e-APDs, large-area 250-micron diameter e-APDs, and segmented 1-mm x 1-mm e-APDS - each with sixteen 250-micron x 250-micron pixel elements - were mounted to ceramic submounts, tested, and characterized. Under receiver bias, the e-APDs exhibited exponentially increasing gain that exceeded 1250. The devices showed exponentially increasing gain as a function of cutoff wavelength, and with decreased temperature - in agreement with our models for HgCdTe e-APDs. In Phase II, we will optimize HgCdTe films for 1.5-3.6 micron response and fabricate 250-micron diameter e-APD elements, designed for operation with gains exceeding 1250, without excess noise. These e-APDs, when integrated with custom-designed <100 e- rms noise transimpedance amplifiers and optimized to match the e-APDs' capacitance, will realize single photon sensitive LIDAR receivers for NASA LIDAR applications.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Voxtel, Inc.	Supporting Organization	Industry	Beaverton, Oregon

Primary U.S. Work Locations	
Maryland	Oregon

Project Transitions

**December 2007:** Project Start**March 2010:** Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - └ TX09.4 Vehicle Systems
 - └ TX09.4.4 Atmosphere and Surface Characterization